MITOSIS - WHEN CELLS SPLIT APART

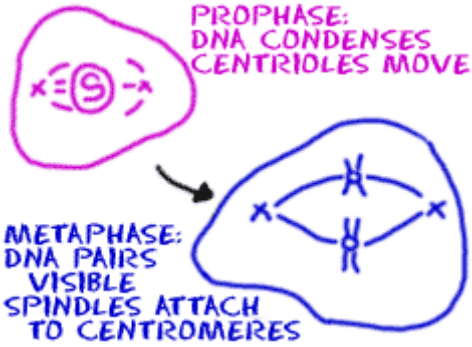
Eventually cells need to duplicate. There are two main methods of replication, mitosis and meiosis. The big idea to remember is that mitosis is the simple duplication of a cell and all of its parts. It duplicates its DNA and the two new cells (daughter cells) have the same pieces and genetic code. Two identical copies come from one original. Start with one; get two that are the same. You get the idea.

Beyond the idea that two identical cells are created, there are certain steps in the process. There are five (5) basic phases in the life-cycle of a cell. You should remember the term PMATI (pronounced PeeMahtEee). PMATI is the acronym for the phases of a cell's existence. It breaks down to.

PROPHASE - METAPHASE - ANAPHASE - TELOPHASE -

INTERPHASE

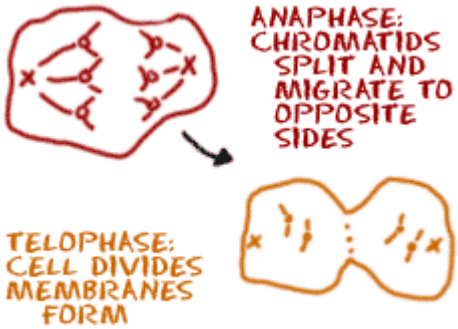
We suppose it would be good to know what happens during those phases. Always remember - PMATI!



THE PHASES

Prophase: A cell gets the idea that it is time to divide. First, it has to get everything ready. You need to duplicate DNA, get certain pieces in the right position (centrioles), and generally prepare the cell for the process of mitotic division.

Metaphase: Now all of the pieces are aligning themselves for the big split. The DNA lines up along a central axis and the centrioles send out specialized tubules that connect to the DNA. The DNA (chromatin) has now condensed into chromosomes. Two strands of a chromosome are connected at the center with something called a centromere. The tubules actually connect to the centromere, not the DNA.



Anaphase: Here we go! The separation begins. Half of the chromosomes are pulled to one side of the cell; half go the other way. When the chromosomes get to the side of the cell, it's time to move on to telophase.

Telophase: Now the division is finishing up. This is the time when the cell membrane closes in and splits the cell into two pieces. You have two separate cells each with half of the original DNA.

Interphase: This is the normal state of a cell. We suppose that when it comes to cell division, you could call this the resting state. It's just going about its daily business of surviving and making sure it has all of the nutrients and energy it needs. It is also getting ready for another division that will happen one day. It is duplicating its nucleic acids, so when it's time for prophase again, all the pieces are there.

MEIOSIS - IT'S FOR SEXUAL REPRODUCTION

What are the big ideas here? There are two cell divisions. Mitosis has one division and **meiosis has two divisions**. You still have to remember PMATI, but now you do it twice. You also need to remember that four cells are created where there was originally one. That's four (4) cells with half of the amount of DNA needed by a cell. When a cell goes through meiosis, it's not concerned about creating another working cell.

Meiosis happens when it's time to reproduce an **organism**. The steps of meiosis are very simple. When you break it down it's just two PMATI's in a row. Scientists say Meiosis I and Meiosis II, but it's just two PMATIs. The interphase that happens between the two processes is very short and the DNA is not duplicated.

As we said, meiosis happens when it's time to reproduce. Meiosis is the great process that **shuffles the cell's genes** around. Plants do it, animals do it, and even fungi do it (sometimes). Instead of creating two new cells with equal numbers of chromosomes (like mitosis), the cell does a second division soon after the first.

That second division divides the number of chromosomes in half. When you have half the number of chromosomes, you are called a haploid cell. **Haploid** means half the regular number. **Diploid** is the opposite (two strands). Normal cells are considered to be diploid cells.

STEP ONE

MEIOSIS I: This is basically like the PMATI of a regular mitosis. Pairs of chromosomes are lined up at the center of the cell and then pulled to each side. Meiosis is a bit different because there something called **crossing-over** happens with the DNA.

This crossing over is an exchange of genes. The genes are mixed up, not resulting in a perfect duplicate like mitosis. The cell divides, leaving two new cells with a pair of chromosomes each. Normally the cell would begin to go about its business of living and slowly duplicate the chromosomes for another mitotic division. Since this is meiosis, there is a very short interphase and division begins again.

STEP TWO

MEIOSIS II: In Prophase II the DNA that remains in the cell begins to condense and form short chromosomes. Each chromosome pair has a **centromere**. The centrioles also begin their journey to opposite sides of the cell. In Metaphase II all of the chromosomes line up along the center of the cell and the centrioles are in position for the duplication. Anaphase II shows the chromosomes split and move to opposite sides of the cell. Each one splits into two pieces. They don't divide up the DNA between the new cells; they split the DNA that exists. Each **daughter cell** will get one-half of the DNA needed to make a functioning cell.

Telophase II shows the DNA completely pulled to the sides and the cell membrane begins to pinch. When it's all over, you are left with four haploid cells that are called **gametes**. The eventual purpose of the gametes will be to find other gametes with which they can combine. When they do, they will form a new organism.